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Spontaneous regression of thoracic malignancies

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Summary
Background: Clinicians are frequently questioned by patients about the possibility of spontaneous regression of tumors. Although there are many reports and a few case series documenting spontaneous regression, there is concern that these cases may not represent true regression. Using specific criteria, we attempted to determine the incidence and types of thoracic malignancy most likely to regress spontaneously.
Methods: We used a PubMed search of the phrase "spontaneous regression of thoracic lesions" reported from 1951 to December 2008. Using a modified Everson and Cole criterion we developed to define spontaneous regression, this search was refined for true spontaneous regression of primary and metastatic thoracic malignancies.
Results: Only 5 cases in the literature involved spontaneous regression of a primary thoracic malignancy. These include pleural mesothelioma, primary lung cancer and adenoid cystic carcinoma. 71 cases involved true spontaneous regression of metastatic thoracic neoplasms, of which 5 cases showed regression of the primary extrapulmonary tumors along with the pulmonary metastasis. Thoracic metastasis from renal cell carcinoma was the most common malignancy found to regress spontaneously.
Conclusion: Spontaneous regression of primary thoracic malignancy is rare. Renal cell carcinoma accounts for most reported cases.

Background

Spontaneous regression of malignancy was first defined as "the partial or complete disappearance of the tumor in the absence of all treatment or in the presence of therapy which is considered inadequate to exert a significant influence on neoplastic disease."[1,2] However, this definition leads to interpretation of what represents "inadequate

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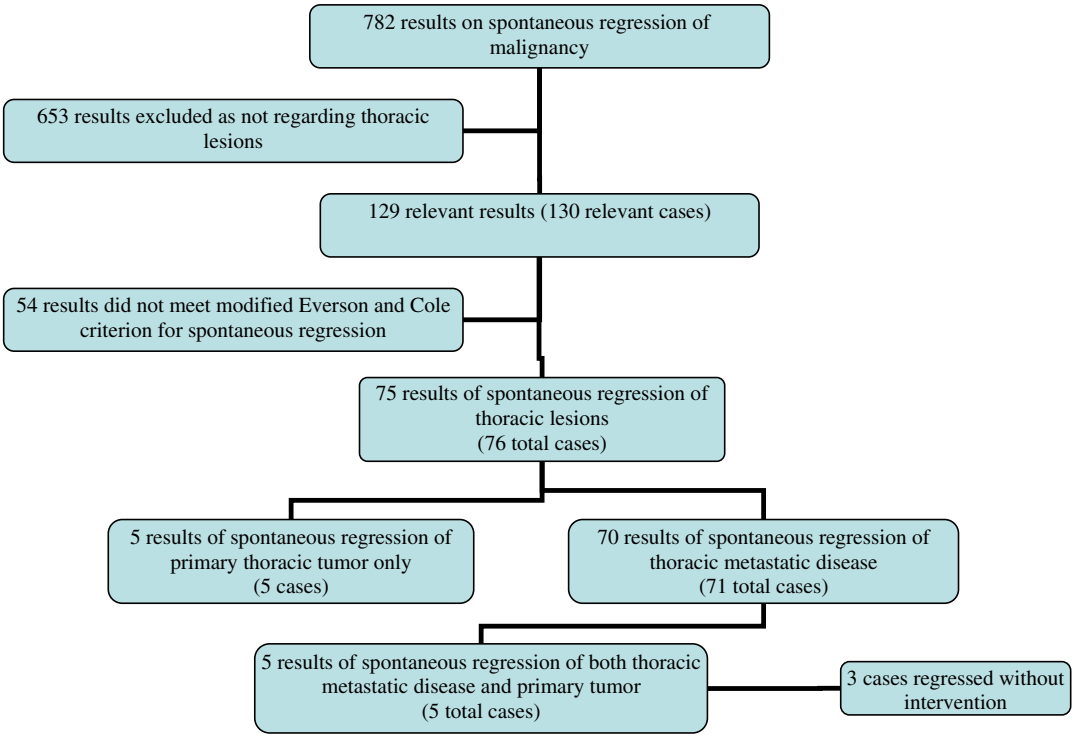

Figure 1 Flowchart representing the study method.

therapy". By excluding reported cases of regression of thoracic tumors in patients who received any form of therapy, the number of confirmed cases of "true" spontaneous regression will be less than the total published cases. We sought to determine types of thoracic malignancies, both primary and metastatic, most likely to regress spontaneously and to review the possible mechanisms for this phenomenon.

Methods

Search strategy

We conducted a PubMed search using the search terms "spontaneous regression of thoracic lesions" with filters for human subjects older than 19 years in all languages from January 1951 to December 2008. It returned 782 results.

Inclusion criteria

We included only those articles that described true spontaneous regression of thoracic lesions as defined by a "modified Everson and Cole criterion" which we developed.[2] This criterion is defined as: 1) the partial or complete disappearance of the tumor in the absence of all systemic or local treatment of the primary or metastatic lesion, 2) patients receiving any systemic therapy were excluded (chemotherapy, radioablative techniques, chemoembolization), 3) primary malignancy was histologically diagnosed or if no biopsy was done to document metastatic spread, the thoracic lesion had to appear metastatic radiographically and in clinical context.

Study selection

Two reviewers (TK and NP) each reviewed independently all 782 abstracts that were included in the initial search, and excluded articles that did not describe regression of thoracic tumors by the modified Everson and Cole criterion. Only cases that met these criteria were included. Disagreements regarding eligibility were resolved by a third reviewer (AT).

Data extraction and analysis

The following were recorded from each article: patient age and sex, type of primary and metastatic tumor present, if and when biopsies were done, treatments if any that were received, and time to tumor regression. The opinions of each articles author on the etiology of spontaneous regression from each article were also recorded. Results were divided into cases of regression of a primary thoracic malignancy, and cases of regression of thoracic metastases (Figs. 1 and 2)

Results

Of the 76 cases of spontaneous regression of thoracic malignancy, more were described in men (48 cases) than in women (28 cases). They tended to occur in those 40—60 years of age (35 cases, 45%), followed by those aged 60—80 years (28 cases, 36%), and finally the least common age group of 20—40 years (13 cases, 19%).

Primary thoracic malignancies that underwent spontaneous regression are reviewed in Table 1. These included 2 cases of pleural mesothelioma, one of adenoid cystic

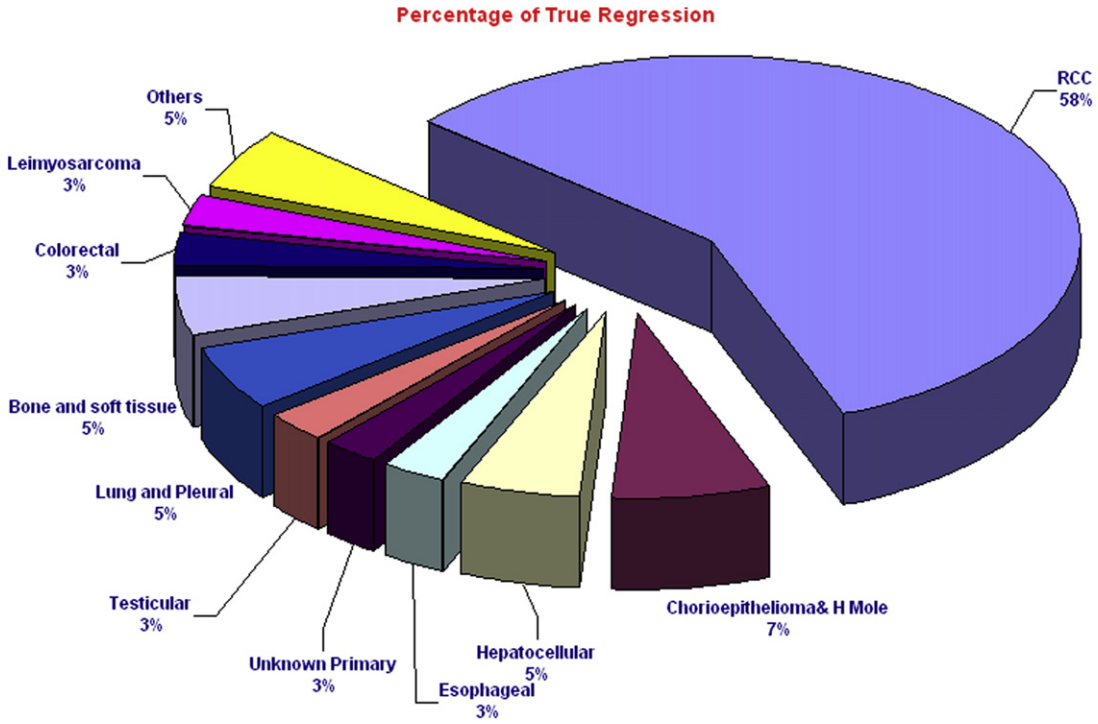

Figure 2 Graphical representation of percentage of regression of all 76 cases.

carcinoma, and two cases of primary lung cancer (squamous cell and "bronchogenic").

Of the metastatic tumors to the chest that regressed spontaneously, renal cell carcinoma (RCC) was the most common, accounting for 43/70 cases (60%). Thirty-four of these cases (79%) were reported to regress within a year of nephrectomy or other resection of the primary tumor. Other tumors reported to regress spontaneously are summarized in Table 2. Hepatocellular carcinoma, endometrial stromal sarcoma, pleomorphic liposarcoma, esophageal cancer, and leiomyosarcoma were the only malignancies noted to have regression of both the primary tumor and the thoracic metastases.[3–7]

Discussion

The Everson and Cole review listed 176 cases of regression of malignant tumors, the majority of which described regression of pulmonary metastases. As in their review, we found that renal cell cancer was the most common thoracic lesion to regress spontaneously.

The mechanisms underlying spontaneous regression of tumors are entirely speculative. In many cases, the regression of metastases occurs after removal of the primary tumor. It is thus suggested that removal of the primary tumor provokes an immune response that eradicates the remaining tumor. This theory is most often used to explain spontaneous regression of RCC, where most regressions appeared within 1 year of nephrectomy.[8] Like RCC, choriocarcinomas may also regress following hysterectomy.[9,10]

Another hypothesis for spontaneous regression is that certain tumors and their metastases, like RCC, grow more rapidly than their blood supply causing them to undergo central necrosis.[11] This may result in direct necrosis and regression of metastatic lesions or necrosis of the primary lesion provoking an immune response similar to that achieved with resection of the primary tumor. Other cancers that share this rapid growth pattern that also have been observed to undergo spontaneous regression include metastases from choriocarcinoma and hepatocellular carcinoma.[12]

Some authors have made mention of pyrexia before the final clearing of lung metastases. This old theory of

Table 1 Spontaneous regression of primary thoracic cancer.

	Primary	Metastasis	Reference	Author Views
1	Pleural Mesothelioma	Pleural	[17]	Natural history of the disease
2	Pleural Mesothelioma	Pleural	[18]	Natural history of the disease
3	Squamous cell carcinoma	Adrenal	[19]	Psychologic versus depression mediated
4	Adenoid cystic carcinoma	Pulmonary, Subcutaneous	[20]	Multiple resections or primary changes in diet
5	Bronchogenic carcinoma	Pulmonary	[6]	None Provided

Table 2 Spontaneous regression of thoracic metastases.

	Primary	Metastasis	Reference	Author Views
1	RCC	Pulmonary	[22]	Loss of tumor secreted prometastatic growth factors by nephrectomy
2	RCC	Pulmonary	[23]	Loss of tumor secreted prometastatic growth factors by nephrectomy
3	RCC	Pulmonary, Scalp	[8]	Immunologic overactivation by tumor burden reduction
4	RCC	Pleura, Parenchyma	[28]	Possibly immunologic
5	RCC	Pulmonary	[31]	None Provided
6	RCC	Pleural	[32]	Possibly immunologic
7	RCC	Pulmonary	[34]	None Provided
8	RCC	Pulmonary	[7]	Possibly immunologic or hormonal
9	RCC	Pulmonary, Neck	[35]	Immune system overactivation by tumor burden debulking
10	RCC	Pulmonary	[36]	Postsurgical
11	RCC	Pulmonary	[37]	Postsurgical
12	RCC	Pulmonary	[38]	Nephrectomy or hormonal
13	RCC	Pulmonary	[39]	Nephrectomy
14	RCC	Pulmonary	[14]	Generation of antineoplastic cytotoxic cells, production of immunoregulatory cytokines by lymphocytes and monocytes, or cross—reaction between tumor and bacterial antigens
15	RCC	Pulmonary	[41]	None Provided
16	RCC	Pulmonary	[42]	None Provided
17	RCC	Pulmonary	[43]	Possibly immunologic or hormonal
18	RCC	Pulmonary	[45]	Steroids
19	RCC	Pulmonary	[46]	None Provided
20	RCC	Pulmonary	[48]	Possibly immunologic or hormonal
21	RCC	Pulmonary	[49]	None Provided
22	RCC	Pulmonary	[51]	Loss of tumor secreted prometastatic growth factors by nephrectomy
23	RCC	Pulmonary	[52]	Fever or infection (mainly tuberculosis), post surgical, ischemia in metastatic foci, loss of tumor secreted prometastatic growth factors by nephrectomy, hormonal (mainly in males), or immunologic changes in lung parenchyma filled macrophages, lymphocytes, and immunoglobulins. Bone metastasis, in contrast, do not regress
24	RCC	Pulmonary	[53]	Possibly immunologic or hormonal
25	RCC	Pulmonary	[54]	None Provided
26	RCC	Pulmonary	[55]	Possibly immunologic
27	RCC	Pulmonary	[56]	Possibly immunologic or hormonal
28	RCC	Pulmonary	[57]	Hormone and immune activation by wound infection and progesterone therapy
29	RCC	Pulmonary	[59]	Estrogen or fevers prior to surgery
30	RCC	Pulmonary	[3]	Possibly immunologic
31	RCC	Pulmonary	[60]	None Provided
32	RCC	Pulmonary	[4]	None Provided
33	RCC	Pulmonary	[5]	Nephrectomy or hormonal
34	RCC	Pulmonary	[61]	Immunologic, hormonal, infection, or removal of carcinogen
35	RCC	Pulmonary	[64]	None Provided
36	RCC	Pulmonary	[66]	None Provided
37	RCC	Pulmonary	[67]	None Provided
38	RCC	Pulmonary	[68]	Possibly immunologic or hormonal
39	RCC	Pulmonary	[69]	None Provided

Table 2 (*continued*)

	Primary	Metastasis	Reference	Author Views
40	RCC	Pulmonary	[70]	Immunologic, hormonal, calcium, or nephrectomy
41	RCC	Pulmonary	[11]	Mechanical effect of tumor emboli on vessels, or antibodies to tumor
42	RCC (autopsy diagnosed)	Pulmonary	[71]	None Provided
43	Assumed Clear cell Carcinoma	Pulmonary	[25]	Immune overactivation by tumor burden reduction from ablation
44	HCC	Pulmonary	[12]	Transition from necrosis to fibrosis of the metastatic HCC
45	HCC	Pulmonary	[24]	Possibly immunologic involving host cytokines
46	HCC	Chest Wall	[78]	None Provided
47	HCC	Pulmonary	[13]	Steroids, hormones or herbal preparations
48	Chorioepithelioma	Pulmonary	[75]	Lytic substances in lung during pregnancy
49	Chorioepithelioma	Pulmonary	[76]	Lytic substances in lung during pregnancy
50	Chorioepithelioma	Pulmonary	[77]	Lytic substances in lung during pregnancy
52	Choriocarcinoma	Pulmonary	[9]	Lytic substances in lung during pregnancy
51	Choriocarcinoma	Pulmonary	[73]	None Provided
53	Testicular Cancer	Pulmonary	[21]	Immunologic or removal of primary tumor
54	Testicular Cancer	Pulmonary	[74]	Hormones or post surgery
55	Leiomyosarcoma	Pulmonary	[13]	Immunologic
56	Leiomyosarcoma	Pulmonary	[58]	Hormonal dependence removed by hysterectomy and bilateral salpingo-oophorectomy
57	Adenocarcinoma unknown primary	Pulmonary	[26]	Possibly aloe vera, immunologic activation by infection or steroids for cryptogenic organizing pneumonia
	Adenocarcinoma rectum	Pulmonary		
58	Unknown	Mediastinal Lymph Node	[27]	None Provided
59	Giant Cell Tumor	Pulmonary	[29]	None Provided
60	Osteogenic Sarcoma	Pulmonary	[33]	None Provided
61	Soft Tissue Tumor	Pulmonary	[50]	Possibly hormonal
62	Esophageal Cancer	Pulmonary	[40]	Post surgical, fever, improved immunity after improved nutrition
63	Malignant Melanoma	Pulmonary, Lymph Node	[44]	Post surgical immune system stimulation
64	Mucin Producing Adenocarcinoma Colon	Pulmonary	[47]	Biological control exerted by host
65	Transitional Cell Cancer	Pulmonary	[62]	Immunologic, hormonal, infection, or removal of carcinogen
66	Hydatiform Mole	Pulmonary	[63]	None Provided
67	Prostate Cancer	Pulmonary	[65]	None Provided
68	Breast Cancer	Pulmonary	[72]	Removal of source of hormone by adrenalectomy
69	Endometrial Stromal Sarcoma	Pulmonary	[79]	Effector T- cell related
70	Pleomorphic Liposarcoma with Lung Metastasis	Pulmonary, Local	[80]	Recurrent removal of primary tumor

HCC- Hepatocellular Carcinoma RCC- Renal Cell Carcinoma.

regression by induction of infection, classically the Coley's toxin, may also have a role. Infection may cause an immunologic reaction resulting in eventual fibrosis of the metastatic lesions. Other events noted to precede spontaneous regression include trauma, surgery, bleeding, blood transfusions.[13] Other popular hypotheses include changes in diet or intake of nutritional supplements, drugs, herbal medications, hormones or steroids. It should also be mentioned that intense meditation and prayer were mentioned as associative factors. Mechanisms proposed revolve around hormonal or immunologic mediation.[18,19,81]

In this analysis we included some older cases reporting lesions which appeared to be metastatic clinically and

radiographically but were not studied histologically. These lesions in cases where histologic diagnosis was not determined could have been inflammatory, such as cryptogenic organizing pneumonia, pulmonary infarction or infection, all of which may occur in association with malignancy.[14–16]

There were only five cases of regression of primary thoracic lesions reported over this long time period. An explanation for this must consider the variable of human error. Mesothelioma, two of the five cases, is notoriously difficult to diagnosis benign from malignant. Additionally, on very rare occasions biopsies are misplaced creating a situation where a malignant tumor may be diagnosed in a patient with a benign lesion.

The major limitation of this study is its retrospective design, but a prospective analysis of spontaneous regression of thoracic malignancies is impossible, as they are so rare.

Conclusion

Spontaneous regression of thoracic malignancies is rare. Regression of primary thoracic malignancies has been reported only with squamous and bronchogenic carcinoma, pleural mesothelioma and adenoid cystic carcinoma. Regression of thoracic metastases, on the other hand, has been reported in many more malignancies but the overwhelming majority of cases involve metastatic renal cell carcinoma. Overall, this still appears to be a rare event, but when it occurs, it seems to follow resection of the primary tumor.

Conflict of interest Statement

There are no conflicts of interest to report for any of the authors.

References

1. Stewart FW. Experiences in spontaneous regression of neoplastic disease in man. *Tex Rep Biol Med* 1952;**10**(1):239–53.
2. Everson TC, Cole WH. Spontaneous regression of malignant disease. *J Am Med Assoc* 1959 Apr 11;**169**(15):1758–9.
3. Boasberg PD, Eilber FR, Morton DL. Immunocompetence and spontaneous regression of metastatic renal cell carcinoma. *J Surg Oncol* 1976;**8**(3):207–10.
4. Baert L, Tanghe W. A case of renal adenocarcinoma with spontaneously regressing pulmonary metastases. *J Urol Nephrol (Paris)* 1971 Mar;**77**(3):225–34.
5. Mathias DB. A case of spontaneous regression of pulmonary metastases arising from hypernephroma following nephrectomy. *Br J Urol* 1971 Feb;**43**(1):65.
6. Eckhart PW. Disappearing lung lesion. *Med J Aust* 1983 Feb 5;**1**(3):104.
7. Czaplicki M, Malewski AW, Kuzaka B, Mayzner-Zawadzka E. The puzzle of spontaneous regression of pulmonary metastasis of renal carcinoma (after many years of observing the patient). *Pol Tyg Lek* 1993 May 17–31;**48**(20–22):485–7.
8. Chang KC, Chan KL, Lam CW. Spontaneous regression of renal cell carcinoma metastases. *Hong Kong Med J* 1999 Mar;**5**(1):72–5.
9. Garber Jr EC, Morrison RH. Spontaneous regression of pulmonary metastases following hysterectomy for choriocarcinoma. *Am J Obstet Gynecol* 1958 Oct;**76**(4):812–6.
10. Mandelboim O, Vadai E, Fridkin M, Katz-Hillel A, Feldman M, Berke G, Eisenbach L. Regression of established murine carcinoma metastases following vaccination with tumor-associated antigen peptides. *Nat Med* 1995 Nov;**1**(11):1179–83.
11. Samellas W, Marks AR. Apparent spontaneous regression of pulmonary metastases following nephrectomy for adenocarcinoma of the kidney. *J Urol* 1961 Apr;**85**:494–6.
12. Toyoda H, Sugimura S, Fukuda K, Mabuchi T. Hepatocellular carcinoma with spontaneous regression of multiple lung metastases. *Pathol Int* 1999 Oct;**49**(10):893–7.
13. Kojima H, Tanigawa N, Kariya S, Komemushi A, Shomura Y, Sawada S, Arai E, Yokota Y. A case of spontaneous regression of hepatocellular carcinoma multiple lung metastases. *Radiat Med* 2006;**24**(2):139–42.
14. Chander K, Feldman L, Mahajan R. Spontaneous regression of lung metastases: possible BOOP connection? *Chest* 1999 Feb;**115**(2):601–2.
15. Wagner JR, Merino MJ, Pass HI, Linehan WM, Walther MM. Pulmonary infarcts can mimic pulmonary metastases from renal cancer. *J Urol* 1997 Nov;**158**(5):1688–90.
16. de Roo T. Lipiodol accumulations simulating lung metastases as complication after lymphography. *Am J Roentgenol Radium Ther Nucl Med* 1971 Mar;**111**(3):483–5.
17. Allen RK. Apparent spontaneous complete regression of a multifocal malignant mesothelioma of the pleura. *Med J Aust* 2007 Oct 1;**187**(7):413–5.
18. Kawanishi R, Ueoka H, Tabata M, Shibayama T, Yano T, Matsushita A, Chikamori K, Kohara H, Harada M, Ohnoshi T. Spontaneous regression of malignant pleural mesothelioma. *Int J Clin Oncol* 1997;**2**:118–20.
19. Sperduto P, Vaezy A, Bridgman A, Wilkie L. Spontaneous regression of squamous cell lung carcinoma with adrenal mets. *Chest* 1988 Oct;**94**(4):887–9.
20. Grillet B, Demedts M, Roelens J, Goddeeris P, Fossion E. Spontaneous regression of lung metastases of adenoid cystic carcinoma. *Chest* 1984 Feb;**85**(2):289–91.
21. Kato M, Ikeda Y, Namiki S, Saito S, Ito A, Arai Y. Spontaneous regression of pulmonary metastases from testicular embryonal carcinoma. *Int J Urol* 2008 Mar;**15**(3):265–6.
22. Lekanidi K, Vlachou PA, Morgan B, Vasanthan S. Spontaneous regression of metastatic renal cell carcinoma: case report. *J Med Case Rep* 2007 Sep;**18**(1):89.
23. Masue N, Hasegawa Y, Moriyama Y, Ikeda Y, Gotoh T, Deguchi T. Spontaneous disappearance of multiple lung metastases after nephroureterectomy from sarcomatoid carcinoma of the renal pelvis: a case report. *Int J Urol* 2007 Jan;**14**(1):75–8.
24. Heianna J, Miyauchi T, Suzuki T, Ishida H, Hashimoto M, Watarai J. Spontaneous regression of multiple lung metastases following regression of hepatocellular carcinoma after transcatheter arterial embolization. A case report. *Hepatogastroenterology* 2007 Jul-Aug;**54**(77):1560–2.
25. Sánchez-Ortiz RF, Tannir N, Ahrar K, Wood CG. Spontaneous regression of pulmonary metastases from renal cell carcinoma after radio frequency ablation of primary tumor: in situ tumor vaccine? *J Urol* 2003 Jul;**170**(1):178–9.
26. Wadsworth SJ, Davies CW, Gray W, Gleeson FV. Spontaneous regression of pulmonary metastases demonstrated by CT. *Br J Radiol* 1999 Mar;**72**(855):304–7.
27. Takemura M, Osugi H, Tokuhara T, Kinoshita H, Higashino M. Case of spontaneous regression of metastatic lesions of leiomyosarcoma of the esophagus. *Dis Esophagus* 1999;**12**(4):317–20.
28. Kawasaki H, Yoshida J, Yokose T, Suzuki K, Nagai KF, Hojo F, Kodama T, Nishiwaki Y. Primary unknown cancer in pulmonary hilar lymph node with spontaneous transient regression: report of a case. *Jpn J Clin Oncol* 1998 Jun;**28**(6):405–9.
29. Siebenrock KA, Unni KK, Roch MG. Giant-cell tumor of bone metastasising to the lungs. A long-term follow-up. *J Bone Joint Surg Br* 1998 Jan;**80**(1):43–7.

31. Edwards MJ, Anderson JA, Angel JR, Harty JI. Spontaneous regression of primary and metastatic renal cell carcinoma. *J Urol* 1996 Apr;**155**(4):1385.
32. Thoroddsen A, Gudbjartsson T, Geirsson G, Agnarsson BA, Magnusson K. Spontaneous regression of pleural metastases after nephrectomy for renal cell carcinoma—a histologically verified case with nine-year follow-up. *Scand J Urol Nephrol* 2002;**36**(5):396—8.
33. Noordijk EM, Kroon HM, van der Heul RO. Spontaneous growth arrest of lung metastases of osteosarcoma with a 28-year follow-up. *Eur J Cancer* 1994;**30A**(1):127.
34. Mangiapan G, Guigay J, Milleron B. A new case of spontaneous regression of metastasis of kidney cancer. *Rev Pneumol Clin* 1994;**50**(3):139—40.
35. MacManus MP, Harte RJ, Stranex S. Spontaneous regression of metastatic renal cell carcinoma following palliative irradiation of the primary tumor. *Ir J Med Sci* 1994 Oct;**163**(10):461—3.
36. Geraads A, Carpentier A, Plagne R. Is spontaneous regression of pulmonary metastasis of renal cancer possible? Apropos of a case with review of the literature. *Rev Pneumol Clin* 1993;**49**(5):233—42.
37. Vogelzang NJ, Priest ER, Borden L. Spontaneous regression of histologically proved pulmonary metastases from renal cell carcinoma: a case with 5-year followup. *J Urol* 1992 Oct;**148**(4):1247—8.
38. García Tabar PJ, Montoya Lirola MD, Etxepare Arrosagaray P, Castillo Jimeno JM, Acinas García O, Alvarez Martínez J. Spontaneous disappearance of pulmonary metastasis secondary to renal cell carcinoma after nephrectomy. Presentation of a case and review of the literature. *Actas Urol Esp* 1992 May;**16**(5):430—4.
39. de Riese W, Goldenberg K, Allhoff E, Stief C, Schlick R, Liedke S, Jonas U. Metastatic renal cell carcinoma (RCC): spontaneous regression, long-term survival and late recurrence. *Int Urol Nephrol* 1991;**23**(1):13—25.
40. Ohwada S, Miyamoto Y, Fujii T, Oyama T, Joshita T, Izuo M. Spontaneous regression of esophageal carcinoma with pulmonary metastases: case report. *Jpn J Clin Oncol* 1990 Jun;**20**(2):193—8.
41. Oliver RT, Nethersell AB, Bottomley JM. Unexplained spontaneous regression and alpha-interferon as treatment for metastatic renal carcinoma. *Br J Urol* 1989 Feb;**63**(2):128—31.
42. Al-Derwish OM, Mokete M, Kuppurajan N, Matanhelia SS. Spontaneous regression of pulmonary metastases from renal cell carcinoma detected by computed tomography. *BJU Int* 2007 Dec;**92**(s3):e30.
43. Chapple CR, Gannon MX, Shah VM, Newman J. Spontaneous regression of pulmonary metastases from renal adenocarcinoma before nephrectomy. *Br J Surg* 1987 Jan;**74**(1):69—70.
44. Mikhail GR, Gorsulowsky DC. Spontaneous regression of metastatic malignant melanoma. *J Dermatol Surg Oncol* 1986 May;**12**(5):497—500.
45. Kavoussi LR, Levine SR, Kadmon D, Fair WR. Regression of metastatic renal cell carcinoma: a case report and literature review. *J Urol* 1986 May;**135**(5):1005—7.
46. Barré C, Vérine JL, Régnier J, Enon B, Houssin A, Chaigné P, Soret JY. Spontaneous regression of regressive pulmonary metastases from kidney cancer. Myth or reality? Apropos of 2 cases. *Ann Urol (Paris)* 1986;**20**(4):275—9.
47. Poh SC, Chiang SC. Temporary spontaneous regression of lung cancer. *Singapore Med J* 1984 Oct;**25**(5):354—8.
48. Nakano E, Sonoda T, Fujioka H, Okuyama A, Matsuda M, Osafune M, Takaha M. Spontaneous regression of pulmonary metastases after nephrectomy for renal cell carcinoma. *Eur Urol* 1984;**10**(3):212—3.
49. Skriver M, Nielsen JK. Spontaneous regression of pulmonary metastases after nephrectomy for renal cell carcinoma. *Ugeskr Laeger* 1995 Oct 30;**157**(44):6138—9.
50. Spontaneous regression of metastasizing soft tissue sarcoma. *Lakartidningen* 1983 Apr 20;**80**(16):1698—9.
51. Davis SD, Koiumi JH, Pitts WR. Spontanoues regression of pulmonary metastasis from renal cell carcinoma. *Urology* 1989;**33**:141—4.
52. Viville C. Spontaneous regression of pulmonary metastases of hypernephromas. Grawitz' tumor. *Acta Urol Belg* 1981 Jul;**49**(3):371—6.
53. Gelfand ML, Begner JA. Clearing of pulmonary metastases after nephrectomy for hypernephroma. *Bull N Y Acad Med* 1981 June;**57**(5):378—81.
54. Smith Jr JA, Herr HW. Spontaneous regression of pulmonary metastases from transitional cell carcinoma. *Cancer* 1980 Sep 15;**46**(6):1499—502.
55. Mohr SJ, Whitesel JA. Spontaneous regression of renal cell carcinoma metastases after preoperative embolization of primary tumor and subsequent nephrectomy. *Urology* 1979 Jul;**14**(1):5—8.
56. Vizel M, Oster MW, Austin JH. Spontaneous regression of a pulmonary metastasis after nephrectomy for renal cell carcinoma. *J Surg Oncol* 1979;**12**(2):175—80.
57. Ludwig G, Jentzsch R, Nuri M. Spontaneous regression of pulmonary metastases from hypernephroma: report of a case and review of literature. *Med Klin* 1977 Dec 9;**72**(49):2118—21.
58. Horstmann JP, Pietra GG, Harman JA, Cole NG, Grinspan S. Spontaneous regression of pulmonary leiomyomas during pregnancy. *Cancer* 1977 Jan;**39**(1):314—21.
59. Wasko R. Regression of pulmonary metastases from renal carcinoma. *Urology* 1976 Mar;**7**(3):299—301.
60. Silber SJ, Chen CY, Gould F. Regression of metastases after nephrectomy for renal cell carcinoma. *Br J Urol* 1975 Jun;**47**(3):259—61.
61. Bross W, Bross T, Kaniowski T, Kozuszek W, Olejak B, Masiak M, Krupacz R. Protracted regression of lung metastases in the course of kidney cancer surgery and after cytostatic treatment. *Wiad Lek* 1970 Sep 15;**23**(18):1587—9.
62. Lome LG, Navani S, Isamettin MA. Spontaneous regression of pulmonary metastases from transitional cell carcinoma of the bladder. *Cancer* 1970;**26**:415—8.
63. Benett MS. Spontaneous regression of pulmonary metastases following hydatidiform mole. *Br J Clin Pract* 1968 Jul;**22**(7):305—7.
64. Markewitz M, Taylor DA, Veenema RJ. Spontaneous regression of pulmonary metastases following palliative nephrectomy. Case report. *Cancer* 1967;**20**:1147—54.
65. Sica A. Spontaneous regression of pulmonary metastases in a case of chorioepithelioma. *Rass Int Clin Ter* 1967 Mar 15;**47**(5):266—80.
66. Schapira HE, Oppenheimer GD. Spontaneous disappearance of pulmonary metastases in hypernephroma. Final report of twenty year follow-up after nephrectomy. *J Mt Sinai Hosp N Y* 1967 Jan—Feb;**34**(1):11—6.
67. Rauh S, Duhem C, Ries F, Dicato M, Lamy S, Lens V. Spontaneous regression of pulmonary metastases in renal cancer. *Bull Soc Sci Med Grand Duche Luxemb* 1998;**135**(1):39—42.
68. García Talavera I, Muñoz Méndez J, Díaz Lobato S, Granado S. Spontaneous regression of pulmonary metastases. *Med Clin (Barc)* 1991 Apr 6;**96**(13):517—8.
69. Andrews JT. Spontaneous disappearance of pulmonary metastases in carcinoma of the kidney. *Med J Aust* 1965 Aug 7;**2**(6):241—2.
70. Garfield DH, Kennedy BJ. Regression of metastatic renal cell carcinoma following nephrectomy. *Cancer* 1972 Jul;**30**(1):190—6.
71. Sakula A. Spontaneous regression of pulmonary metastases secondary to carcinoma of kidney. *Brit J Dis Chest* 1963;**57**:147—52.

72. Dao TL. Regression of pulmonary metastases of a breast cancer. Report of a case of spontaneous and temporary regression after radical mastectomy. *Arch Surg* 1962 May;**84**:574—7.
73. Natsume M, Takada J. Choricarcinoma. An unusual case recurring 9 years after subtotal hysterectomy and followed by spontaneous regression of pulmonary metastases. *Am J Obstet Gynecol* 1961 Sep;**82**:654—9.
74. Fedon M. Spontaneous regression of pulmonary metastases of a malignant tumor of the testicle. *Chir Ital* 1960 Aug;**12**: 458—88.
75. Chun D, Hou PC. Spontaneous regression of pulmonary metastases in a case of chorioepithelioma. *J Obstet Gynaecol Br Emp* 1957 Apr;**64**(2):22—6.
76. Rube W. Spontaneous regression of lung metastases of a chorion epithelioma. *Fortschr Geb Rontgenstr Nuklearmed* 1954 Nov;**81**(5):638—42.
77. Johnson W. Spontaneous and complete regression of extensive pulmonary metastases in a case of chorionepithelioma. *Am J Obstet Gynecol* 1951 Mar;**61**(3):701—4.
78. Jeon SW, Lee MK, Lee YD, Seo HE, Cho CM, Tak WY, Kweon YO. Clear cell hepatocellular carcinoma with spontaneous regression of primary and metastatic lesions. *Korean J Intern Med* 2005 Sep;**20**(3):268—73.
79. Ota S, Shinagawa K, Ueoka H, Tada S, Tabata M, Hamazaki S, Kondo E, Kiura K, Mannami T, Shibayama T, Niiya K, Harada M. Spontaneous regression of metastatic endometrial stromal sarcoma. *Jpn J Clin Oncol* 2002 Feb;**32**(2):71—4.
80. Chang WY. Complete spontaneous regression of cancer: four case reports, review of literature, and discussion of possible mechanisms involved. *Hawaii Med J* 2000 Oct;**59**(10):379—87.
81. Meares A. Atavistic regression as a factor in the remission of cancer. *Med J Aust* 1977 Jul 23;**2**(4):132—3.